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Hybrid PIC Simulations of Stimulated Brillouin Scattering Including Ion-ion Collisions*

P. W. Rambo, S. C. Wilks and W. L. Kruer

University of California, Lawrence Livermore National Laboratory

We investigate the role of Coulomb collisions in non-linear saturation and heating due to stimulated Brillouin scattering (SBS) in laser heated plasmas. Ion-ion collisions are particularly relevant to SBS from high-Z plasmas, where the collision rate of heated ions can be appreciable compared to the acoustic frequency. Our kinetic modeling makes use of particle-in-cell (PIC) techniques with binary Monte Carlo (MC) particle-particle collisions that are equivalent to the Fokker-Planck collision operator. For plasmas composed of high and low-Z ion mixtures (*e.g.* Au-Be), simulations show that collisions can maintain near-linear damping for finite-amplitude waves by reducing the population of trapped ions. Inclusion of collisions reduces SBS compared to collisionless simulations due to modifications to the non-linearly heated distribution function. For single species plasmas (*e.g.* Au), collisions reduce the heat flow compared to free-streaming conduction, locally decreasing ZT_e/T_i which in turn reduces SBS at late time compared to collisionless simulation. We note that similar effects with regard to electron-ion collisions may effect stimulated Raman scattering. We also present results on numerical heating in hybrid simulations, which is particularly severe for plasmas with large ratio of sound speed to ion-thermal speed, $ZT_e/T_i >> 1$; we have investigated the effect of smoothing, particle number, and particle-grid interpolation on this numerical heating.

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